

DNA Barcoding and Integrative Taxonomy of the *Heterolepisma sclerophylla* species complex (Zygentoma: Lepismatidae: Heterolepismatinae) and the Description of Two New Species

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ABSTRACT. We present one of the first studies of DNA barcodes (COI sequences) in the basal insect order Zygentoma, and compare the data with nuclear (28S) and mitochondrial (16S) rDNA sequences and morphology for an integrative taxonomic study of the *Heterolepisma sclerophylla* Smith species group. DNA sequence analyses identified deep divisions between Queensland and New South Wales populations, and among populations in each state. Detailed morphological and morphometric evaluation of the specimens failed, in most cases, to identify unambiguous morphological characters of diagnostic value for each population, possibly due to the interaction of morphological conservatism with high levels of variability resulting from their continued moulting after reaching sexual maturity. Several strong consistent characters were identified to support the description of a southern Queensland population as a new species (*Heterolepisma cooloola* sp. nov.). The combined molecular and morphological data support the view that the presence of lanceolate scales and the absence of macrochaetae from the anterior margin of the frons are more significant to phylogeny than the arrangement of styli and the shape of the thoracic sternites in *Heterolepisma*. Specimens from Glen Davis, NSW, while indistinguishable from *H. sclerophylla* in all other characters examined, were found to possess one fewer pair of abdominal styli in both sexes and are also described as a new species (*Heterolepisma coorongooba* sp. nov.). Five lineages are recognized within the remaining NSW material but as reliable (non-overlapping) morphological and morphometric differences could not be identified, they are not described here as new species. *Heterolepisma sclerophylla* sensu stricto is considered to be a complex of morphologically ill-defined species or perhaps subspecies.

The silverfish subfamily Heterolepismatinae Mendes, 1991 is poorly understood but quite diverse in spite of a certain superficial uniformity. Twenty-four species have been described with a mainly Gondwanan distribution extending to coastal southern Japan, Vietnam, Angola, Mozambique, Somalia, Zanzibar as well as to many Pacific and Indian Ocean Islands, but Smith (2017) suggested that there may

be more than 100 morphospecies in Australia alone. In Australia the genus can be found in habitats ranging from the fringes of tropical rainforest to the dry deserts and even rarely in subalpine regions. Specimens are collected from dry leaf litter, under or within cavities in the bark of dead or living trees, sometimes under stones and occasionally within abandoned termite galleries. Several authors (Wygodzinsky,

Keywords: Thysanura; taxonomy; new species; DNA barcodes; 28S ribosomal DNA

Taxonomic registration: (LSID publication) <http://zoobank.org/124BD25A-7712-4EC6-9A1E-48FC9C23B513>

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Received: 2 May 2017 **Accepted:** 8 December 2018 **Published:** 13 March 2019 (in print and online simultaneously)

Publisher: The Australian Museum, Sydney, Australia (a statutory authority of, and principally funded by, the NSW State Government)

Citation: Graeme B. Smith, Andrew Mitchell, Timothy R. C. Lee, and Luis Espinasa. 2019. DNA barcoding and integrative taxonomy of the *Heterolepisma sclerophylla* species complex (Zygentoma: Lepismatidae: Heterolepismatinae) and the description of two new species. *Records of the Australian Museum* 71(1): 1–32. <https://doi.org/10.3853/j.2201-4349.71.2019.1677>

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